

WHAT IS CLAIMED IS:

1. A method for depositing a target material on a semiconductor wafer, wherein the wafer comprises a first material layer, an overlying second material layer and a plurality of openings in the second material layer extending to the first material layer, the method comprising:

sputtering target material particles from a target;

controlling power supplied to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into one or more of the plurality of openings; and

depositing the target material particles on the wafer.

2. The method of claim 1 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a deposition rate of target material particles on the wafer.

3. The method of claim 1 wherein the material comprising the target is selected from between titanium and tantalum.

4. The method of claim 1 wherein one or more of the plurality of openings comprise high aspect ratio openings.

5. A method for depositing a target material on a semiconductor wafer, wherein the wafer comprises a first material layer, an overlying second material layer and a plurality of openings in the second material layer extending to the first material layer, the method comprising:

providing a target comprising the target material;

supplying power to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into the plurality of openings;

positioning the wafer below the target;

sputtering target material particles in response to impinging particles directed toward the target;

forming a plasma of ionized target material particles from the sputtered target material particles between the target and the wafer;

supplying power to the wafer to attract the ionized target material particles to the wafer; and

depositing the ionized target material particles on the wafer.

6. The method of claim 5 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a deposition rate of ionized target material particles on the wafer.

7. The method of claim 5 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a density of the impinging particles.

8. The method of claim 5 wherein the material comprising the target is selected from between titanium and tantalum.

9. The method of claim 5 wherein the particles impinging the target comprise argon ions.

10. The method of claim 9 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a velocity of the argon ions.

11. The method of claim 9 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a density of the argon ions.

12. The method of claim 9 further comprising forming a magnetic field to confine the argon ions in a region proximate the target.

13. The method of claim 5 wherein the step of forming the plasma further comprises providing radio frequency power to a coil positioned between the target and the wafer, and wherein the target material particles pass through the coil.

14. The method of claim 13 further comprising increasing the radio frequency power to increase a number of ionized target material particles.

15. The method of claim 5 wherein the material is deposited on a bottom surface of the plurality of openings.

16. The method of claim 5 wherein one or more of the plurality of openings comprise high aspect ratio openings.

17. The method of claim 5 wherein the step of supplying power to the target further comprises supplying power to the target to increase an intensity of an electric field formed by the power supplied to the target.

18. The method of claim 5 wherein the step of supplying power to the wafer further comprises supplying radio frequency power to the wafer.

19. A method for controlling a physical vapor deposition process for depositing material from a target onto a semiconductor wafer comprising a plurality of features and positioned below the target, the method comprising:

- forming an electric field in a region of the target;
- directing particles toward the target;
- sputtering target material from the target in response to the particles;
- forming a plasma between the target and the wafer, wherein the sputtered target material is ionized by the plasma to form ionized target material;
- supplying radio frequency power to the wafer for attracting the ionized target material to the wafer;
- depositing the ionized target material on the wafer; and
- controlling the electric field to maintain the wafer temperature below a critical temperature, above which wafer features can sustain damage.

20. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to increase the velocity of the particles directed toward the target to effect an increase in an amount of sputtered target material.

21. The method of claim 19 wherein the step of directing particles further comprises introducing argon molecules, ionizing the argon molecules to form a plasma of argon ions in a region of the target, and attracting the argon plasma to the target.

22. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to increase an amount of sputtered target material.

23. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to increase a rate at which ionized target material is deposited on the wafer.

24. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to reduce the wafer temperature during the step of depositing the ionized target material on the wafer.

25. An apparatus for depositing material on a substrate having a plurality of openings formed therein, the apparatus comprising:

- a target formed from the material to be deposited on the substrate;

a source of impinging particles directed toward the target, wherein target material is released from the target in response to the impinging particles, wherein the released target material is deposited on the substrate;

a controllable power source connected to the target, wherein the power delivered by the power source is controlled to maintain the wafer temperature below a critical temperature during the deposition process; and

a wafer chuck for supporting the wafer during the deposition process.

26. The apparatus of claim 25 wherein the power delivered by the power source is controlled to increase the deposition rate of target material on the substrate.

27. The apparatus of claim 25 wherein the target material comprises titanium or tantalum.

28. The apparatus of claim 25 wherein one or more of the plurality of openings comprise high aspect ratio openings.

29. The apparatus of claim 25 further comprising a coil disposed between the wafer chuck and the target for forming a target material plasma and a radio frequency power source connected to the coil, wherein the target material plasma is formed as the target material passes through the coil.

30. The apparatus of claim 29 further comprising a power source for biasing the wafer to attract the target material plasma to the wafer.